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XXXI. *On the Nature and Formation of Sponges: In a Letter from John Ellis, Esquire, F. R. S. to Dr. Solander, F. R. S.*

S I R,

Read Dec. 19, 1765. **Y**OU, who study nature in an eminent degree, view her in all her works proceeding by regular gradations from the lowest to the most perfect of all created beings; among those animals commonly called Zoophytes, you may plainly discover an evident approximation, from the rudest irregularly-formed sponge (which is the lowest being that I have yet observed to have the appearance of animal life) to the most beautiful and elegant red coral.

The nature and formation of sponges having never yet been thoroughly investigated, every attempt to explain this dark part of nature must give satisfaction to the curious. The intent, then, of this letter is to convey to the Royal Society, through your hands, what we have seen in the experiments we made on them at the sea side; the substance of what has been said on the subject by moderns as well as ancients; and lastly, to shew how nearly they approach to the Alcyoniums, a class of beings next
above

above them in the scale of nature, as being one step nearer to the appearance of animals.

If we consult the ancients, we shall find, that, in the days of Aristotle, the persons, who made it their business to collect these substances, perceived a particular sensation, like shrinking, when they tore them off the rocks; and, in the time of Pliny, the same opinion continued of their having a kind of feeling or animal life in them; but after his time no attention was paid to this kind of knowledge, and it still remained a doubt, till the illustrious Count Marfigli pronounced them vegetable, as he did all the corals, keratophytoms, and alcyoniums, &c.

After him, it fell to the lot of the ingenious Dr. Peyssonell, in his Enquiries, to discover them to be animals, or rather, as he calls it, the fabric of animals, formed by a species of *urtica marina* (see his manuscript which he sent to the Royal Society in the year 1752); but finding upon re-examining these intricate bodies in sea water at Guadaloupe, he favours the Royal Society with a letter dated from thence, March 1, 1757. Vid. Phil. Transact. vol. L. p. 592. wherein he has given a particular account of the animal, which he assures us forms the sponges. There is something so remarkable in his description of the animal, and its manner of fabricating the sponge, that I am obliged to quote the most striking parts, in order to submit the probability of it to you and the rest of the Royal Society.

He takes notice, " that the same kind of animal
" forms the four principal species of sponges described
" by Father Plumier, as the *tube sponge*, the *cord-*
" *like sponge*, the *digitated sponge*, and the *honey-*
" *comb sponge*.

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“ These sponges,” he says, “ consist of hard firm
 “ fibres, twisted about in doubles, and the interstices
 “ filled with a mucilaginous gluey matter, having large
 “ hollows, with cylindrical tubes, dispersed through
 “ their substance, forming a kind of labyrinth filled
 “ with these worms.

He says, he has observed, “ that the sponges be-
 “ gin to be formed on a nodule of petrified sand or
 “ other like matter, round which the worms begin
 “ to work, and round which they retire as to their
 “ last seat or refuge.

He then proceeds to give a description of
 them, which is, “ that they are $\frac{1}{3}$ of a line thick,
 “ two or three lines long, of a conic figure, with a
 “ small black head furnished with two pincers ; the
 “ other extremity is square, and much larger than
 “ the head ; their motion begins at the tail, and ends
 “ at the head ; they are so transparent, that the cir-
 “ culation of the blood may be perceived ; and
 “ where the viscera should be, there is a kind of
 “ circular motion of a blackish matter moving to
 “ and fro in the animal. He says, he has kept
 “ them alive more than an hour out of the sponge,
 “ and (which is very singular) when he put them
 “ near a piece of fresh sponge, where the nests were
 “ moist, and from which he had before pulled them,
 “ he saw them enter and disappear. He goes on
 “ to tell us, that these worms have no particular
 “ lodge ; that they walk indifferently into the tubu-
 “ lar labyrinth ; so that, he says, without offence to
 “ Pliny and other naturalists, he does not see that it
 “ is in their power to dilate and contract the bodies
 “ of sponges, which always remain in the same state
 “ of

“ of magnitude, without being sensible to the touch,
 “ being an inanimate body ; all the sensitive life be-
 “ longing to the worms.

“ He then tells us, that with the flaver or juice
 “ they deposit, they make the sponge encrease or
 “ grow, as bees and wasps, and especially the wood-
 “ lice of America, encrease their nests and cells.”

This account appearing so contrary to the proceeding of nature in the formation of the other kindred marine bodies, called Zoophytes, such as corals, keratophytens, and alcyoniums, particularly the last ; I was determined to find out the truth of this extraordinary discovery, which I found had been thought worthy of a place in our Transactions.

Accordingly, in the year 1762, when we were together at the sea side at Brighthelmstone, we dissected carefully the *spongia medullam panis referens*, or crumb of bread sponge, in hopes of discovering the small animals that were supposed to fabricate them ; and were surprized to find a great number of small worms in them, particularly a very small kind of *nereis*, or sea-scolopendra : but these worms appeared evidently, instead of being the fabricators of it, to have pierced their way into its soft substance, and made it only their place of retreat and security. After this, we proceeded along the sea coast to Little Hampton, near Arundel, on the coast of Sussex, where we took up out of the sea several specimens of the same sort of sponge full of an orange-coloured gelatinous matter ; and, while they were just fresh from the sea, we examined them (after they had rested for some time) in glasses of sea water ; and to our great surprise, instead of seeing any of the polype-like suckers,

or any minute animal figure, come out of the papillæ, or small holes with which they are surrounded, we only observed these holes to contract and dilate themselves. And as a further confirmation of this motion, being at Hastings in Suffex, in August 1764, in company with Dr. Gowin Knight, F. R. S. we collected from the rocks at ebb-tide, just under water, a variety of the same kind of sponge, but of a pale yellow colour, and in the form of several cocks combs united together, the tops of which were full of tubular cavities or papillæ: when we examined these in glasses of sea-water, we could plainly observe these little tubes to receive and pass the water to and fro; so that the sponge is an animal *sui generis*, whose mouths are so many holes or ends of branched tubes opening on its surface; with these it receives its nourishment, and by these it discharges, like the polypes, its excrements.

But, to give a further proof of sponges sucking in and throwing out the sea-water, I shall quote a passage from that fair investigator of nature, the celebrated Count Marfigli, in his *Histoire Physique de la Mer*, p. 53. who, notwithstanding he took them for plants, as well as he did corals, &c. has in his chapter on Sponges this curious observation, which proves quite the contrary.

“ J’ai un fond suffisant de ces plantes pour en faire
 “ une botanique entiere, & plusieurs reflexions curieuses sur la systole & diastole, que j’ai observées,
 “ dans certains petits trous ronds de ces plantes, lors
 “ qu’elles sortent de la mer, mouvement qui dure
 “ jusqu’à ce que l’eau soit entierement consumée.”

In English thus: “ I have a sufficient stock of these
 “ plants

“ plants (sponges) to make a compleat botanical
 “ collection, with many curious remarks, which I
 “ have made on the systole and diastole, which I
 “ have observed in certain small round holes, when
 “ they are first taken out of the sea; this motion
 “ continues in them till the water they contain is
 “ entirely wasted away.”

Nothing can more clearly describe what I have seen in our sponges; so that, making an allowance for the then prevailing opinion that they were vegetables, I think, he comes nearer the truth than Dr. Peysonell's account of the formation of sponges by little animals, that walk to and fro in the labyrinth of the tubes to construct his extraordinary animal fabric.

I come now to shew you how near they approach to the alcyoniums in their internal form and manner of growth.

In order to explain this, I have given you the perpendicular and horizontal sections of the common officinal sponge*; because this is in the power of most gentlemen to examine. And, in vol. LIII. of the *Philos. Trans.* Tab. 20. Fig. 10. *c. b.* 11 and 13. I have given the perpendicular and horizontal sections of the *alcyonium manus marina*, both magnified and in the natural size; because specimens of this kind are likewise easily obtained, being found in plenty on rocks and shells near the Isle of Sheppey, at the entrance of the river Thames.

You'll observe, the connected tubes of both arise from the part to which they adhere to the rocks, &c. From hence both kinds branch out and swell into irregular lobes, with this difference, that the surface

* See Tab. X. fig. E and D.

of the sponge is covered with holes guarded with minute points like little spines; the surface of the alcyonium with starry openings of eight rays, from whence the polype-like suckers are protruded, in order to find out proper nourishment: and these starry openings in one, and the holes in the other, so far correspond, that in both kinds they are found of different sizes; but this is in proportion to the age of the branching tubes that come to the surface.

In the sections of the alcyonium you may plainly distinguish the reticulated elastic fibres, that enclose the transparent stiff gelatinous part, as in the sponges: but, as this gluey substance is of a firmer texture than what is found in sponges, it requires more pains to separate it from the elastic fibres; however, with a little trouble it may be done sufficiently to evince what I have endeavoured to prove, I mean, the great proximity there is between the animal life of sponges and alcyoniums, and consequently that both are animals.

Before I conclude, I must endeavour to remove some doubts, which seem to have distressed the generality of curious persons to account for; the one is, what occasions those very large holes that appear here and there irregularly on the surface of most sponges? the other is, how came those extraneous bodies, such as small shells, stones, and even parts of fucuses, in the middle of these animal bodies? In answer to the first, upon cutting open and examining these bodies while recent in sea-water, as I have shewn before, we frequently find a variety of different worms, who bore their way into them, and make their nests and retreats there, or perhaps to live
on

on the gelatinous part of the sponge. This the celebrated Donati confirms, in his History of the Adriatic Sea ; who endeavouring to find out, like Peysonell, the animal fabricator of the *alcyonium primum Dioscoridis*, which approaches very near to the sponges : he met with many irregular cavities in it, and also different kinds of inhabitants ; one of them he has particularly described and figured. Vide Donat. Hist. M. Adriat. p. 58. t. 8. fig. G. But he very judiciously says, these are not the fabricators, but the inhabitants ; and allows the alcyonium to be of animal origin, in which he says he has discovered evident marks of sensation.

As to the second doubt, it may be observed by the curious enquirer into nature, that the same property of enclosing extraneous substances is common to the whole class of Zoophytes, as they grow up, from the sponge to the red coral. In order to prove this, I have various specimens as well of sponges as keratophytos and corals, with different bodies enclosed in them, both animal and vegetable. I have specimens where even the red coral encloses the white coral, and the white the red ; with many keratophytos, that have enclosed small roundish shells of the barnacle tribe, thought by some superficial enquirers into nature (who would have them to be vegetables) to be the fruit of the keratophytos. Vid. Phil. Transf. vol. L. p. 853. Tab. 34. Fig. 19. a. I am,

S I R,

Your most obedient servant,

Gray's-Inn,
Dec. 5, 1765.

John Ellis.

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An Explanation of the PLATES.

PLATE X.

A is an irregular piece of the crumb of bread sponge, found at Pagham on the sea-coast of Suffex; *aa* represent the papillæ, through which the sponge receives and discharges the water; this, when recent, is of a fine orange colour.

FIG. B is the branched English sponge; at *bb*, along the edges, and on the surface of the branches, are rows of small papillary holes, through which the animal receives its nourishment.

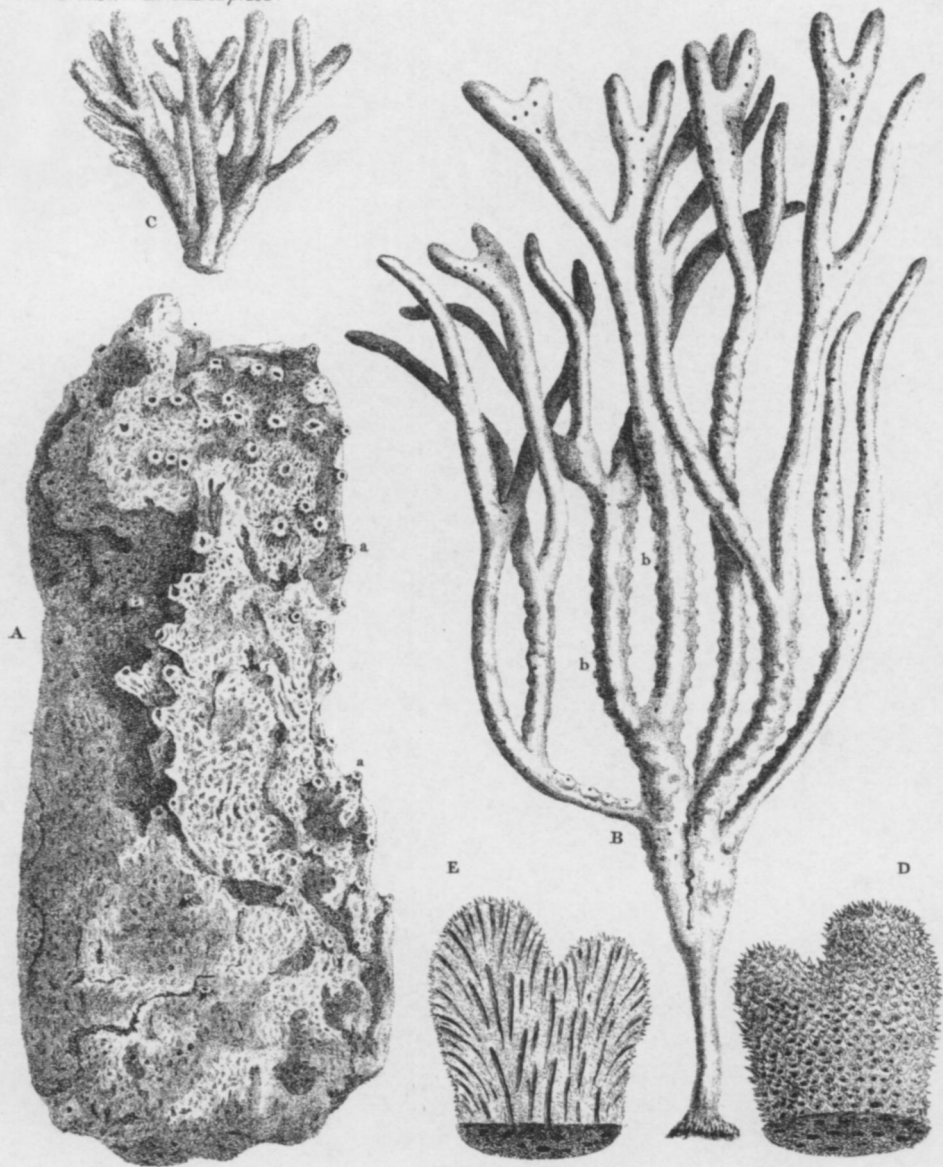
FIG. C represents the downy branched English sponge found on the Suffex coast; this is covered over with a fine down so close, that it hides the many small holes that are on its surface.

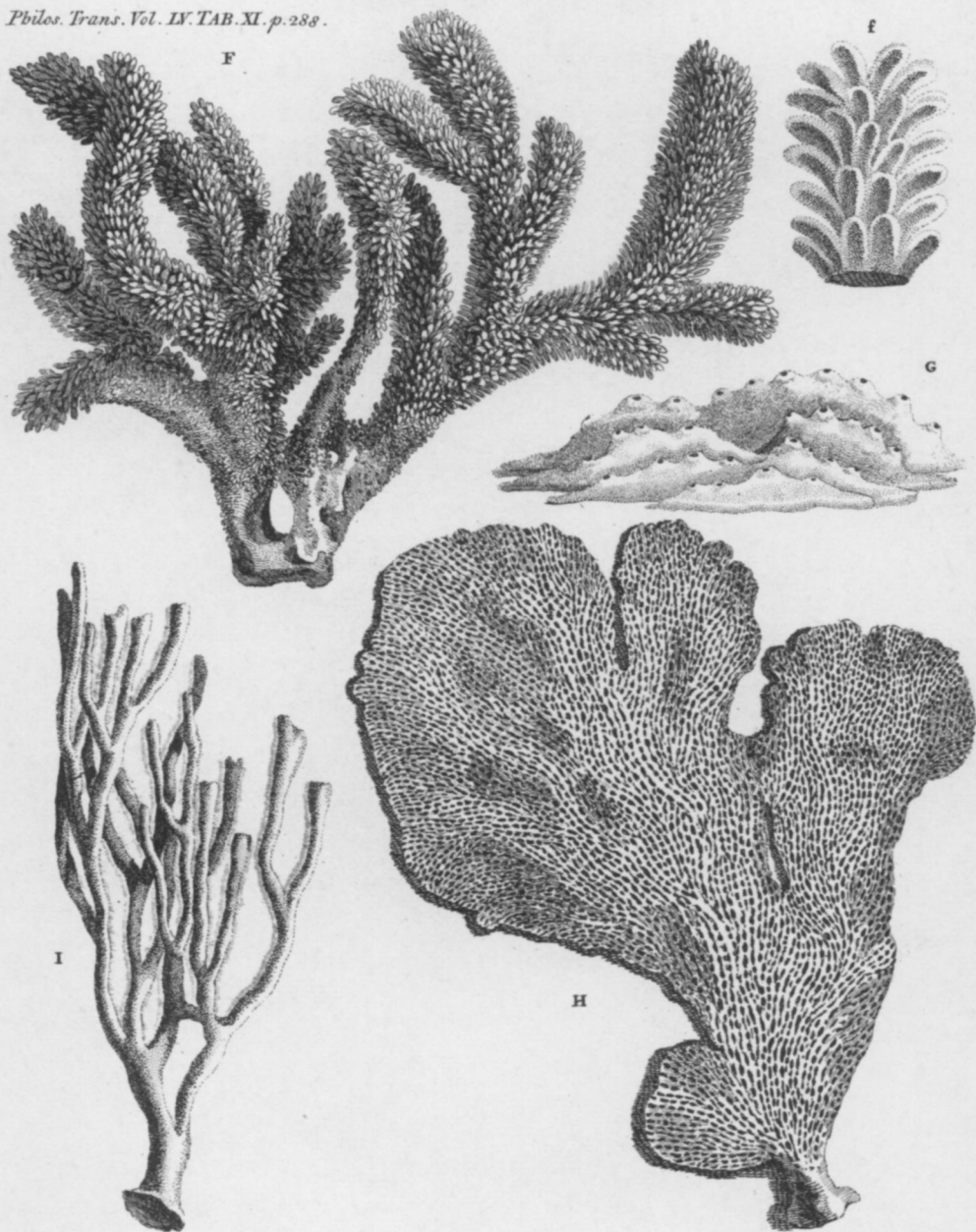
FIG. D and E, the perpendicular and horizontal sections of the common officinal sponge.

PLATE XI.

G is the cocks-comb sponge, taken off the rocks at Hastings in Suffex, and viewed while alive in sea-water. The other sponges, represented here, are introduced to shew the variety of forms these animals appear under in different parts of the world.

FIG. F is a branched tuberculated sponge from Cape Coast Castle in Africa. Fig. *f* represents the appearance of the tubercles in their dried state, when





when magnified. This sponge approaches very near to the figure of the *Corallium album porosum maximum* of Sir Hans Sloane, see the Hist. of Jam. Vol. I. Tab. 18. fig. 3. and of the *Porus albus erectior ramosus tuberculis crebris sursum spectantibus* of Morison. See Hist. Ox. p. 3. Sect. 15. Tab. 10. fig. 3.

FIG. H is a sponge from Stavanger on the coast of Norway; this may be called the Sea-fan sponge, from its great likeness to the keratophyton of that name; all its pores are surrounded with small spiculæ, which, from their minuteness, could not be well represented in the drawing.

The dichotomous branched sponge at FIG. I is of a firm but elastic texture, very full of small holes, guarded by minute spines; this was found on the coast of Norway, and presented to me by my worthy friend Peter Collinson, Esquire, F. R. S.